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Robust Crypto-Governance Graduate Document Storage and Fraud Avoidance Certificate in Indonesian Private University

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***Abstract*—In this study, we considered crypto-governance as a solution for critical problems in private university management: fraud avoidance diplomas, transcripts and diploma supplement. To avoid fraud, it can be done by blockchain technology by the use of University, Company, Traceability, Profit and Policy-making of crypto-governance. Crypto- governance is able to use IBM using hyperledger fabric protocol and private blockchain network. Muhammadiyah Tangerang University (UMT) saved the graduate documents storage manually by human resources. Moreover, it would be wasting time for many tasks, for example when staffs searched database, they would consume a lot of time and the graduate documents were vulnerable to damage in the disaster. Based on the problems above it would face the research questions; how did we keep the graduate documents storage secure and how it could be authentic guaranteed? Blockchain technology with distributed ledger and consensus is considered to overcome this problem. There were 5 steps taken in this research starting from discussing, literature review, analyzing, learning blockchain technology, creating system model and making a conclusion. The conclusions of this study were expected that the data of graduate students could find faster, easily and authentic guaranteed.**

Keywords—blockchain technology, crypto-governance, graduate document, private university, blockchain in private university

I. INTRODUCTION

Our society might be the better due to the support of higher education in industrial 4.0 revolutions. Higher Education is being an essential factor to support human development. Currently, higher education is based on 4.0 revolution or it is popular by Artificial Intelligence (AI). This system will make complicated, dialectical and interesting opportunities for human to be coming a man center characteristic. In the fourth industrial revolution, a new form of university is emerged by teaching, research and services in different ways. As the example, currently, the university is interdisciplinary, has virtual classrooms and laboratories, virtual libraries, and virtual teachers without reduce the educational experience but adds to it [1].

In addition, student-centered with well-integrated learning will make students have a long terms memory of the lessons that have been given by the lecturers at the university [2]. With industrial revolution systems, cloud computing storage is existing. The Big data storage such as be to be development, large industries, medium organizations and small, will get benefits. Table I below explains some benefits of having industrial revolution. According to Tanriogen (2018), the benefit of using revolution industry 4.0 can be seen from 6 criterias, there are ; 1) maximize the production, increase the product's quality, able to be competing, compatible prices, rising the benefit, also protect the security and environmentally friendly [3].

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TABLE I. THE BENEFITS OF INDUSTRY 4.0

No	Criteria	Sub Criteria
1.	Production	- Solve to drown out mistake and damage - Increase product - Get Faster time
2.	Flexibility	- Customize products - Get Appropriate product - Use many components as production controls
3.	Competitiveness	- Cheap production fee - Use the right solution - Adjust dynamic order
4.	Profitability	- Large scale of profits - Speed up the process - Few stock - Well-managed manufacture
5.	Safety	- Avoid failure program - Has Detectors are safeguard worker - Prompt response
6.	Environment	- Dispose objects that are not used - Go green solving - Has Sustainable power

That benefits of industry revolution which is influencing the Cyber Security, Augmented Reality, Cloud Computing, Analysis and Big Data, Robots, IoT, Integration, Physical system security give a positive improvement in education, especially for higher education system [4].

The cyber physical system is very difficult to be applied but will have a very fast impact and change of heart of higher education that will be carried out [5]. As one of the cases, in Vietnam the industrial revolution 4.0 has transformed into an information for society and everything has become very easy and this revolution will change the workforce in the future. There are 3 factors which have been causing a transformation: first, the quality of human resources, the changes in the environment and technological capabilities [6].

IT Governance is one of the ways to support business objectives through a framework of structures, relational mechanisms and information systems [7]. IT Governance is very important for information technology because IT Governance will provide consistency, standards, processes and repeated needs for IT operations to be more effective with lower costs in determining needs. Figure 1 below reviews a holistic perspective on IT governance in organizations for managing security and privacy. Based on the figure 1, it can be seen that both enterprise governance and IT governance are having similar urgency and needs in producing a maximum benefit [8].

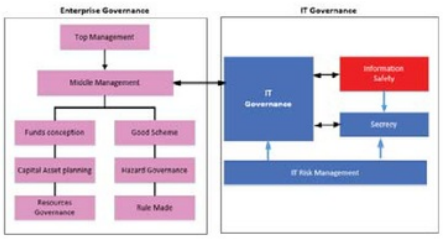

Fig. 1. Holistic Perspective of Enterprise and IT Governance

The core of higher education are research and administrative processes which is requiring effective IT governance. This process requires diverse cloud applications, applications and technologies, different platforms and academic systems. [9].

Based on the previous studies above, it can be found a Gap. Now, research on the management of student graduate data using the blockchain technology is still not widely done by universities. Moreover, it would be wasting time for many tasks, for example when staffs searched database, they would consume a lot of time and the graduate documents were vulnerable to damage in the disaster. Based on these problems, the research questions are promulgated as follows; how did we keep the graduate documents storage secure and how it could be authentic guaranteed?.

The purpose of this study is expected to provide proposal for the crypto-governance graduate document storage and fraud avoidance diplomas, transcripts and diploma supplement model in Muhammadiyah Tangerang University so the data of graduate students could find faster, secure and authentic.

II. THE REVIEW OF PREVIOUS LITERATURE

A. *Blockchain Technology*

Blockchain is a reliable technology for any application that has decentralized technology, encoded and recorded transactions in distributed ledger [10]. Even taught, there is traditional business models on blockchain but, it is very interesting that the blockchain will have a positive impact on society. As adopted from Blasetty (2019), the Figure 2 below describes the blockchain application in business, starting from administrator sending requests to P2P networking and proceeding to the consensus to be validated, after the validation processed, one block or one transaction has been created and that one block is saved into the other blocks as completed transaction process. To make it valid, the process uses a crypto currency system where the hash function is used [11].

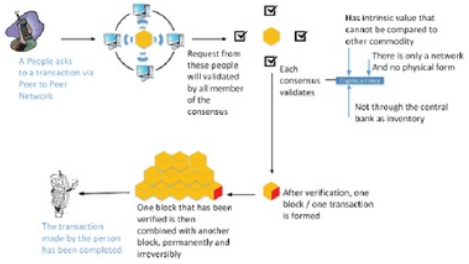

Fig. 2. Blockchain for Business

Peer to peer allows payment without going through third parties; validation process is a digital signature that is used as a solution. It is expected to overcome the problem of multiple expenses, namely *peer to peer networks* [12].

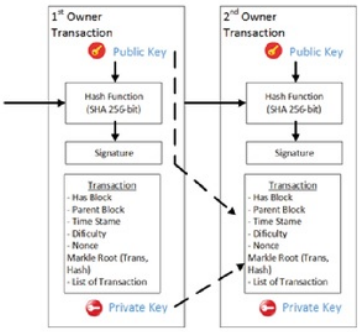

Fig. 3. Transaction Process

Blockchain technology is beneficial because it has many advantages such as: disintermediation, high trust, empowering existing clients in consensus, giving quality information and good processes, verified and fast transactions and cheaper costs [13].

B. Crypto-Governance

The creation and security of trading companies on the blockchain will provide the benefits of agreement and ownership also a cheaper trading process besides that, it will also increase the incentive to do validation in this consensus and also can be done by the smart contrast. [14].

Security in the blockchain is the protection for data transaction and block information (regardless of data form) to against internal threats and intentional or unintentional peripherals. Meanwhile, privacy in the blockchain is the ability to make data transactions without divulging the identified information [15]. Blockchain can be done without the permission of some members who are in an open consensus network for technical needs which have been validated and approved this process [16].

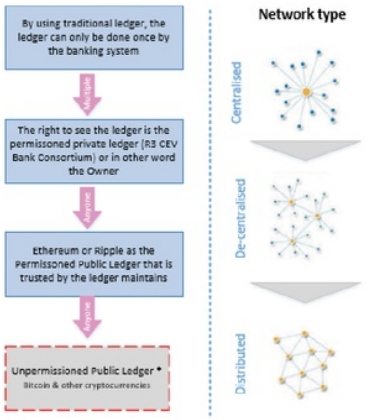

Fig. 4. Understanding blockchain types

By using blockchain technology, it will be proven that the information such as; data, documents, transactions, certificates, news or identities is canceled. If an asset can be given an identifier such as a barcode then this can be entered (see on the blockchain governance). There are at least 4 factors of the governance to use of blockchain [17]

- **Ownership.** From the issuance of certificates to the last process, the block chain is approved and stored which can be digitized.
- **Traceability.** Physical goods can be traced during the life cycle
- **Incentives.** As many as 2 billion people around the world lack services in the banking world.
- **Policymaking.** The blockchain will involve all parties, including the government.

Based on several standard regulations related to information security in various fields, it seems that blockchain is very beneficial and popular [18]. The existing standard regulations consist of :Federal Information Processing Standards (FIPS 140–2), Computer Misuse Act (1990), PAS 555 2013 Cyber Security Risk Governance and Management Specification etc.

C. Indonesian Private University

The Indonesian private university is the higher educational stage after intermediate education that includes diploma program, bachelor program, master program, and doctoral program which is coordinated by the private sector. The Indonesian private University is not only providing profession program but also specialist program. University is an educational unit hold by the Higher Education institution.Chapter I General Provisions Article 1 UU No. 12 of 2012 [19].

The autonomy management of Indonesian Private University is arranged by the Government in the provisions of Article 26 of PP No. 4/2014. Article 28 of Government Regulation No.4 / 2014 stated the state university organization and private university are least consists of elements:

a. Policy maker
b. Academic executor
c. Quality assurance and supervisor
d. Academic support or learning resources, and Implementing administration.

III. RESEARCH METHOD

Robust crypto-governance in Indonesian Private University rises the research that explains on how security governance in Muhammadiyah Tangerang University using blockchain technology. So that the security system of graduates placement test results and transcript could be managed well. Beside that, the used of block chain also provide more level of data security on each higher education. In this research, there are six steps have been conducting which is starting from; having a discussion with the director vise director, head of BAAK, LSP of Muhammadiyah Tangerang University. After that, collecting a literature review in number of 20 references and be classified into 5 categories. The next step is analyzing the system on how the graduates' data is processing until the data is producing. Then, learning the block chain technology system and its security. The last step is creating the crypto-governance model in managing graduates' documents which are consisting of; diplomas, transcripts, and diplomas supplements. At the end, the conclusion is made. These steps are also describing in the flow chart below (figure 5).

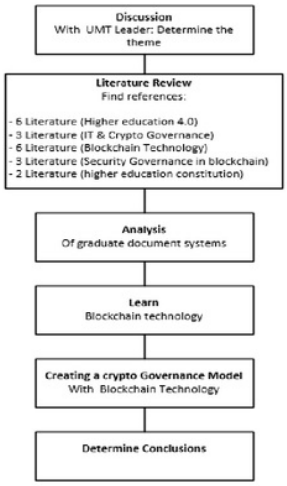

Fig. 5. Research Methodology

IV. RESULTS OF DATA ANALYSIS AND DISCUSSION

A. *The governance of Indonesian Private University*

Referring to the Government Regulation of the Republic of Indonesia Number 4 of 2014 concerning the Implementation of Higher Education and Management of University, in Article 1 Point 2 describes the Higher Education Management is the activity of implementing lane, level and type of Higher Education through the establishment of Higher Education by the Government and / or the Organizing institution to achieve the goals of Higher Education. In addition, in Article 1 point 6 Private College, hereinafter abbreviated as PTS, is an established university and / or organized by the community. Article 31 Provisions regarding PTS organization and governance as referred to in paragraph (1) are regulated inThe Statutes of each PTS which are stipulated by the regulations of the Organizing Body in accordance with the provisions of the legislation.

Higher education governance stated in Article 28 PTN and PTS organizations consist of at least the following elements:

a. policy maker;
b. academic executor;
c. quality assurance and supervision;
d. academic support or learning resources; and
e. executor of administration or administration.

The principles of implementing university autonomy management refers to subsection 63 UU 12 of 2012 dan BAN PT. The principles of implementing autonomy in managing higher education institutions when referring to Article 63 of Law 12/2012 is divided into 5 points, namely: accountability, transparency, non-profit, quality assurance and effectiveness and efficiency. and if referring to the National Accreditation Agency is divided into 5 points as well: credible, transparent, accountable, and responsible.

B. *Graduate Data Management in UMT*

Muhammadiyah Tangerang University is a private university which is built in 2009 in Tangerang city, Banten province- Indonesia. The number of students is kept increasing starting from 2009 to 2017 academic year. The number of students who are accepting in 2017 academic year was about 4.126 with student body was about 17.640 students. Then, in the same year, students graduating was about 2.919 students. From this data, it can be seen that the higher of students accepting will be equal to students graduating, therefore, a university needs a security system to protect graduates' data, such as crypto-governance using blockchain technology.

Figure 6 below describes the process of data management in Muhammadiyah Tangerang University.

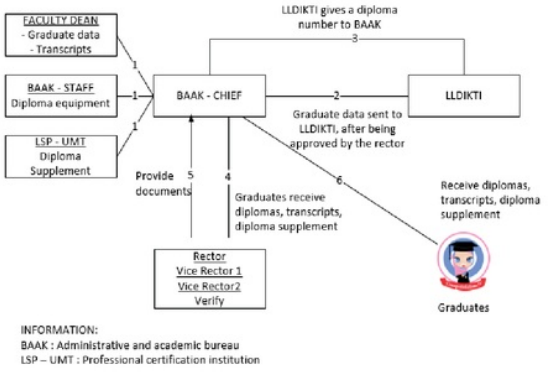

Fig. 6. Management Graduate Document in UMT

The details of figure 6 are explained in the following ways:

1. Faculty dean, BAAK staff, and LSP UMT send the documents to BAAK CHIEF (the documents are classified as into 1) faculty dean: graduates' data, transcripts, 2) BAAK-staff: diploma equipment,3) LSP-UMT: diploma supplement
2. BAAK sends the documents to LLDIKTI in form of graduates' data after being proof read by the rector
3. LLDIKTI gives a diploma with its number
4. BAAK gives diplomas with its number to rector for being validated by vice rector 1 and rector 3.
5. Diplomas is signed by the rector.
6. Rector gives back the diploma to BAAK CHIEF
7. BAAK CHIEF gives graduates' data in form of; diplomas, transcripts, and diplomas supplements to graduates.

Those steps can be optimized by using blockchain technology to manage graduates' data.

C. *Crypto-Governance in UMT*

Recently, management data in UMT has been processed as explained in Figure 6, the processes has running well. However, as the development of era and technology, the data security and validity are needed. The crypto-governance framework by using blockchain technology in Muhammadiyah Tangerang University use 5 essential components, which are: university, traceability, profit, policymaking and company, as this following figure 7 below.

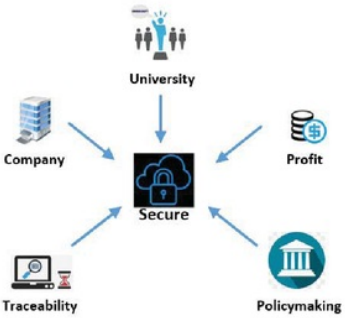

Fig. 7. Crypto-Governance Graduate Document in UMT

From the picture above, explaining on how security management works in higher education. There are 4 points that is an important concentration in the field of data security in a higher education, namely:

1. University
   University is publisher of diplomas, transcripts and diploma supplements are the right of students while UMT as the University only prints and authorizes the document. Because the private network is used, consensus members consist of Rector, Dean, Academic Administration Bureau and Professional certification institution and Blockchain will be developed by UMT.
2. Traceability
   The documents can be tracked easily by students, recruiters or even higher-level universities. This serves to reduce errors and other irresponsible activities. In addition, with traceability, recruiters are able to know the validity of the diploma, the values in the transcript and the number or competencies stated in the diploma supplement and can trace where the document came from.
3. Profit
   For consensus members who are providing approval of activities will be in accordance with the number of approvals made. The more approval or validation, the greater the profit obtained. In addition, stimulus will also be given to staff who have worked directly or indirectly in the academic process.
4. Policymaking
   Policymakers in this matter were the government represented by the Minister of Research and Technology, LLDIKTI and Muhammadiyah Tangerang University.
5. Company
   The company which has in crypto governance is the company that has cooperated with universities and it could be hope will be more comfortable accepting UMT graduates.

The five components become very important in terms of governance of college graduate data and their validity. Thus, the validity of the diploma, transcript and diploma supplements will also be more secure to avoid mistake.

The technology which proposed in the use of crypto governance graduate document storage and fraud avoidance certificate is blockchain technology. IBM is a company that is chosen by using the hyperledger fabrics protocol and private blockchain network to provide security, distributed ledger for transparency and validation of each consensus.

The proposed model can be seen in Figure 8 below.

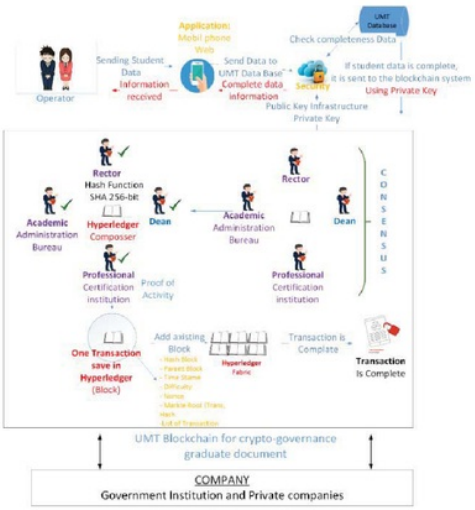

Fig. 8. UMT Blockchain for crypto-governance graduate document

Figure 8 above explains about crypto-governance diplomas, transcripts and diploma companion certificates using a technology blockchain where consensus consists of Rector, Dean, Academic Administration Bureau and Professional Certification Institution. The detailed steps are as follows:

1. Operators consisting of academic administration bureau operators, academic faculty operators, professional certification institution operators. The operator sends data in pdf format to the system which will then be sent to the database of the Muhammadiyah Tangerang university.
2. The database provides information in the form of completeness of the data uploaded. If the data have been completed then there is confirmation to tell the data be ready for sending to the blockchain system for crypto-governance graduate document.
3. If the operator approves it, the document will be sent to the blockchain system by using the private key operator to the public key
4. A consensus consisting of Rector, Dean, Academic Administration Bureau and Professional Certification institution will receive the document and check the completeness and authenticity.
5. Consensus members are having a right to using the function (SHA 256 bit) will provide validation and then the validation will be stored as one transaction or one block which is then stored in distributed ledger.
6. Inside the hyperledger consists of transaction data as follows: hash block, parent block, time stame, difficulty nonce, root markle (trans, hash) and list of transactions.
7. With the hyperledger fabric the ledger is made into the same with another ledger.
8. From step 7, company consisting of government companies, and private companies can see student data by logging in first. To get the user name and password, of course, you must register first
9. Finish.

The advantage that could be expected from using this technology are; having the high level of security of graduate data consisting of diplomas, transcripts and certificates of diploma companion. Besides that, it is also expected to be able to provide a high level of validity because consensus does a cross check before doing validation, so that the data has been passed through validation first. The third, recruiters can cross check by logging in and monitor diploma, transcripts and diploma supplement clearly.

With this technology it is also hoped that recruiters will be more aware of the graduate document because they can check where the results of the check have been agreed upon by the units at the Muhammadiyah Tangerang University consisting of the Chancellor, Dean, Academic administration bureau and professional certification institutions. That point is the hope of the proposed blockchain technology.

V. CONCLUSION AND IMPLICATIONS

In the revolution industry era 4.0, the learning process in education, research, and services are being more complicated and it needs a proper Artificial Intelligence (AI). So that, laboratory, library, and lecturers can be deliver in virtual manners and will get better results rather than using non-virtual account. To cover that needs, blockchain technology can be optimizing to give enormous benefit such as HAS function SHA 256-bit, private key, public key through software web -based cloud and other platforms.

Crypto-governance in UMT using five components which is supporting a graduates' data management are consisting of; university, traceability, profit, policymaking and company. University is the account owner such as graduate title which is given by UMT. Second, traceability is traceable documents that can be tracked by the students or UMT management. Third, profit is the benefit which can be accepted by the consensus members by validation some numbers of documents. The fourth is policy maker, the one who make a policy in validating documents such as; Ministry of education, LLDIKTI, and Muhammadiyah Tangerang University and the last, companies that have collaborated with universities so that they can accept graduates comfortably.

The benefit that is expected from crypto-governance graduate document storage to graduates' documents in UMT are; the system will be more secure by using blockchain technology although the graduate documents were vulnerable to damage in the disaster, the staffs could search the documents faster and easily and the graduate documents storage authentic guaranteed. Moreover, the documents storage could be authentic because every single of consensus member is able to validate the originality of graduates' documents. The other benefits, the companies are able to check the validity of graduates' data and finally if the students find the worse cased (e.g., miss their diplomas) they could track out through this system. Generally, this purposing technology is expected to give many benefits to graduates, university, and companies. The researcher suggests for university to implement this technology model system to protect, secure and validated graduates' data.

REFERENCES

[1] X. Bo and M. Tshilidzi, "Implication of the Fourth Industrial Age on Higer Education". 17 Maret 2017.

[2] U. Krishnan at. All, "Gearing up education towards Industry 4.0". International Journal of Computers & Technology. ISSN: 2277-3061. Vol 17 Issue. 02. 21-09-2018.

[3] M. Miroslav, and B, Slavomir, "Mass customization in the context of industry 4.0: implications of variety induced complexity", pp.21-39. December 2016.

[4] T. Zeynep Meral. "The Possible effects of 4th Industrial Revolution on Turkish Educational System". Eurasian Journal of Educational Research 77 ,2018, 163-184.

[5] G. Nancy W, "Singapore's Higher Education Systems in the Era of the Fourth Industrial Revolution: Preparing Lifelong Learners". ISBN 978-981-13-0193-3. Springer Nature Singapore Pte Ltd. 22 June 2018

[6] T. Huynh Van and A. M. A Le Thai Kim, "The 4.0 Industrial Revolution Affecting Higher Education Organizations Operation in Vietnam". International Journal of Management Technology Vol. 4 No. 2. Pp. 1-12, October 2017.

[7] T. Afaf (2013). "IT Governance Impact on Business Unit Performance". A Thesis in the John Molson School of Business. Concordia University, Canada. December 2013

[8] L. John W et all (2016). "Holistic IT Governance, Risk Management, Security and Privacy: Needed for Effective Implementation and Continuous Improvement", ISACA Journal Vol. 5.2016

[9] B. Isaias Scalabrin and Sousa. Rui Dinis, "IT Governance mechanisms in higher education". Procedia Computer Science 100, 2016, 941-946.

[10] A. Stas T, "Use of Blockchain in the Banking System" KnE Social Sciences, 13 February 2018, pp 576–582.

[11] B. Robert, 2019, "Blockchain for business, Should You Care?", 7 January 2017

[12] N. Satoshi, "Bitcoin: A peer-to-peer electronic cash system", 3 January 2008, https://bitcoin.org/bitcoin.pdf, 2018.

[13] A. Waseem, "Blockchain Technology: Challenges and Future Prospects". International Journal of Advanced Research in Computer Science. Vol 8, No. 9, December 2017.

[14] Y. David, "Corporate Governance and Blockchains". Oxford University Press on behalf of the European Finance Association. Vol 21, Issue 1, March 2017, pp 7-31.

[15] J. Archana Prashanth, H. Meng and W. Yan, "A Survey on Security and Privacy Issues of Blockchain Technology". Mathematical Faoundations of Computing. Volume 1, Number 2 May 2018.

[16] D. Evangeline and W. Alex, "The security and financial implications of blockchain technologies: Regulating emerging technologies in Canada". International Journal 2017. Vol 72(4) 538-562.

[17] C. Guillaume, "The environment needs crypto-governance". Macmillan Publishers Limited, part of Springer Nature. 25 May 2017. Vol 545. P. 403

[18] Z. Efpraxia, H. Ying and P. Matthew, "On the Security Risk of the Blockchain". Journal of Computer Information Systems. ISSN: 0887-4417 (print) 2380-2057.

[19] Republic Indonesia Law no 12, year 2012 about higher education.

[20] Republic Indonesia Government policy no 4, year 2014 about Higher education implementation.

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